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Utilization Of Coconut Fiber Ash Waste As An Added Material In Mortar

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Abstract

Mortar is a mixture of materials composed of fine aggregate (sand), adhesives such as (clay, lime, portlaand cement) and water with a certain composition. Mortar can be affected by several specification factors such as density, mortar age, type of bonding material, and aggregate properties. In this study using coconut fiber ash as an added material in making mortar which has a function as an enhancer of compressive strength value in mortar. In coconut fiber ash, it has an important chemical compound for mortar, namely silica compounds which function as the main element to increase the compressive strength value of mortar. The purpose of the study was to determine the effect of adding coconut fiber ash material on the compressive strength of mortar with a percentage of 0%, 2.5%, 5%, 7.5%, 10%. From the results of the research conducted, a compressive strength value of 253 Mpa was obtained at a percentage of 10% of 7 days old and 253 Mpa at a percentage of 2.5% of 7 days old.

Keywords: *Mortar, Compressive Stength, Coconut Fiber Ash*

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INTRODUCTION

The development of the structural sector in Indonesia is currently experiencing very rapid progress. Along with the increasing population and the need for facilities that support activities such as offices, roads, bridges, residences and other facilities, mortar is one option as a non-structural material in terms of development.

Mortar is a mixture of materials that have components such as fine aggregate (sand), adhesives (clay, portland cement, lime) and water with certain components (SNI 03-6825-2002). Mortar was first made using materials from mud and clay because the supply of stone in ancient times was very limited. According to (National Standardization Guideline No.8 2007), mortar is a mixture of sand, cement, and water materials with certain content variations that are stirred using a tool or mixer machine. Mortar as a building material can be measured the properties contained therein, such as specific gravity, tensile strength, compressive strength, water absorption, and adhesion and adhesion strength (Tjokrodimuljo, K 2012).

East Java Island is one of the largest coconut producing islands ranked No.3 in Indonesia, (Muhammad Choirul Anwar, kompas.com, 2021). Therefore, waste from coconut fibers can be used for various things, one of which is as the main material for substituting cement in mortar. Based on the idea of utilizing coconut fiber waste inspired by household materials to have economic value for the community as the main material for cement substitution in making mortar.

According to (Alexander, 2003), conducted tests on coconut fiber ash (ASK) and obtained the results of the composition of coconut fiber ash compounds containing SiO2 elements of 42.9%; Al 2.26%; Fe 1.16%. The results of this study show that Silica Oxide (SiO2) contained in coconut fiber ash has reactive properties (amorphus) that can cause SiO2 to react chemically with Ca (OH) 2. Silica Oxide (SiO2) acts as an additional material to increase the compressive strength of mortar and reduce cement.

In the previous study (Hendra Taufik, et al, 2013), with a percentage of variation in coconut fiber ash of 0%, 2.5%, 5%, 7.5%, 10%, the compressive strength of mortar increased from normal compressive strength, namely in the percentage variance of 2.5% of the amount of cement. The optimum compressive strength is obtained with a content of 2.5%, which is 17.55 Mpa. In this study using coconut fiber ash as a cement substitution in mortar.

The reason the author took coconut fiber ash as an object of this study is because coconut fibers are very easy to find because they are categorized into waste in traditional markets or households and to utilize coconut fiber waste into materials that can be reused as added material in making mortar.

Therefore, the author became interested in conducting research on the use of coconut fiber ash waste as an added material to mortar with a percentage of the use of coconut fiber ash waste of 0%, 2.5%, 5%, 7.5%, 10% of cement.

RESEARCH METHODS

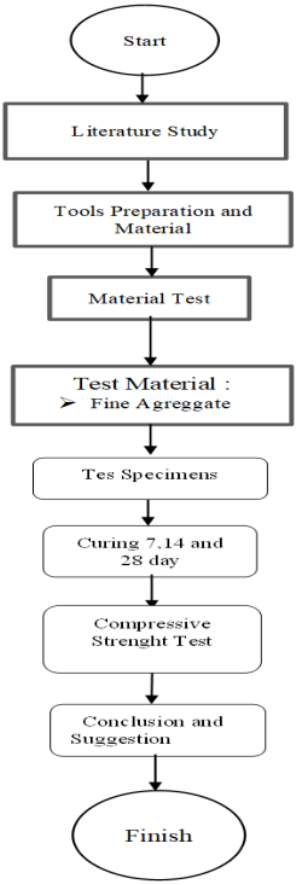

Figure 1. Flow Chart

This research was carried out at the University of August 17, 1945 Surabaya located on Semolowaru Road Number.45, Menur Pumpungan, Sukolilo District, Surabaya. The materials to be used in the study are Portland cement type 2 (PCC), water, and added materials in the form of coconut fiber ash. The following are the specifications of the materials used:

1. Cement

   Portland Composite Cement type 2 (PCC), namely Semen Gresik

2. PAM Water

   Water that does not contain any ingredients or compound elements originating from the Civil Engineering laboratory environment of the University of August 17, 1945 Surabaya.

3. Fine Aggregate (Sand)

   The fine aggregate used is sand originating from the Lumajang Regency.

4. Coconut Fiber Ash

   The coconut fiber ash used is ash obtained from the personal combustion process with a total weight of 70 kg of coconut fibers.

In this study, there were 5 variations in the percentage of the mixture of added coconut fiber ash used. The percentage of coconut fiber ash added material used is 0%, 2.5%, 5%, 7.5% and 10% of the total weight of cement with a total number of test specimens as many as 45 test objects.

Table 1 Test Specimen Planning (Research Data,2023)

Name of The Specimen	Coconut Fiber Ash	Compressive Strength		
		7 Day	14 Day	28 Day
ASK-1	0%	3	3	3
ASK-2	2,50%	3	3	3
ASK-3	5%	3	3	3
ASK-4	7,50%	3	3	3
ASK-5	10%	3	3	3
Total		45 Test Specimens		

RESULTS AND DISCUSSION

1. Material Proportions

In this study the variation in the percentage of coconut fiber ash used was 0%, 2.5%, 5%, 7.5% and 10%. The coconut fiber ash used serves as an added material in the material for making mortar. The specimen used is a cube mold measuring 5 x 5 x 5 cm as a compressive strength test on the mortar. The following is a table of the proportions of the material used in making mortar.

Table 2 Material Proposition Design In Making Mortar

Name of Test Specimens	Coconut Fiber Ash (ASK) %	Cement (gram)
ASK 0	0	0
ASK 2,5	2,5	12,5
ASK 5	5	25
ASK 7,5	7,5	37,5
ASK 10	10	50

2. Tes Result Analysis

After the mortar manufacturing process is completed using a predetermined proportional design arrangement, the next step is to carry out the mortar treatment process by immersion in water for 6 days, 13 days, and 27 days, then a compressive strength test is carried out to determine the compressive strength value of the mortar. Here are the results of the compressive strength testing test.

Table 3 Mortar Compressive Strength Result in 7, 14 and 28 Days (Research Data, 2023)

Content of Coconut Fiber Ash (ASK)	Compressive Strength Age 7 Days	Compressive Strength Age 14 Days	Compressive Strength Age 28 Days
ASK 0%	220	220	313
ASK 2,5%	260	233	213
ASK 5%	187	227	187
ASK 7,5%	173	227	173
ASK 10%	253	213	180

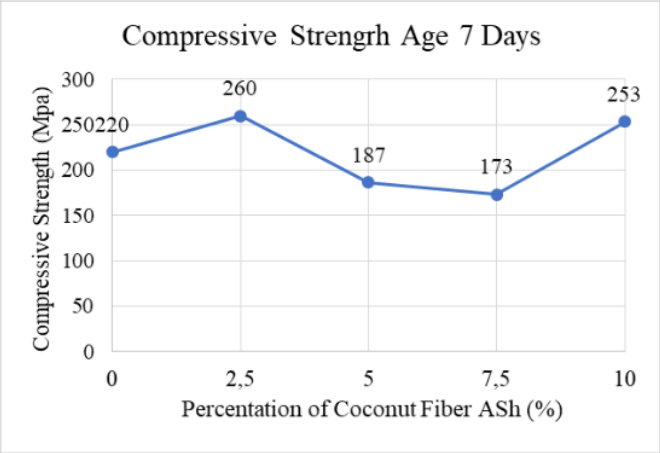

Figure 2 Chart of Compressive Strength Mortar Age 7 Days

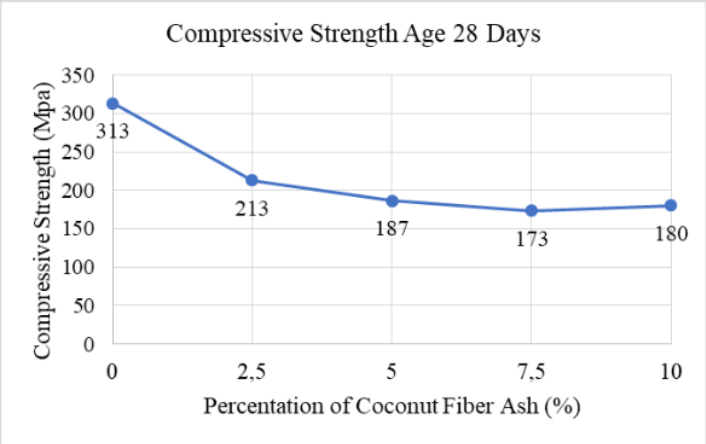

Figure 3 Chart of Compressive Strenght Mortar Age 14 Days

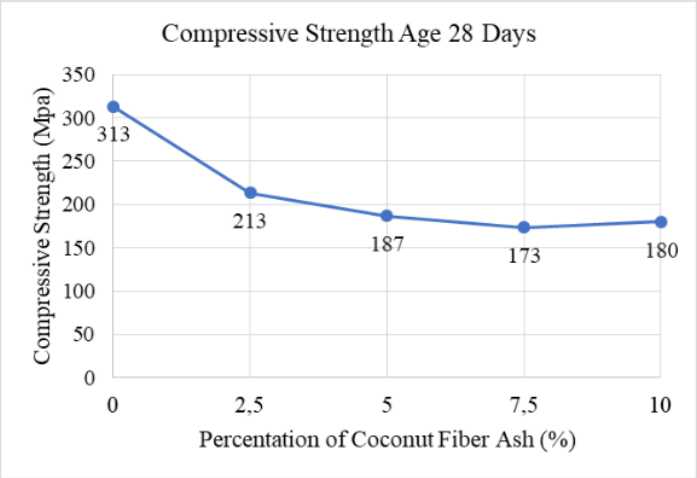

Figure 3 Chart of Compressive Strength Mortar Age 28 Days

Based on the results of the graph above, it can be concluded that at the age of 7 days of soaking mortar (curing) there is an increase in optimum compressive strength in the percentage of coconut fiber ash of 2.5% and 10% with compressive strength of 260 Mpa and 253 Mpa. At percentages of 5% and 7.5% there was a decrease in compressive strength with compressive strength of 187 and 173 Mpa.

At the age of 14 days of curing, there was an increase in compressive strength in the percentage of coconut fiber ash of 2.5%, 5%, and 7.5% with compressive strength of 233 Mpa, 227 Mpa, and 227 Mpa, while in the percentage of coconut fiber ash 10% decreased compressive strength with a compressive strength value of 213 Mpa.

At the age of 28 days of soaking (curing) there was a decrease in compressive strength from the compressive strength of mortar percentage of 0% with a compressive strength value of 313 Mpa. Percentages of 2.5%, 5%, 7.5% and 10% with compressive strength values of 213 Mpa, 187 Mpa, 173 Mpa, 180 Mpa.

CONCLUSION

The compressive strength of mortar with added coconut fiber ash to cement with an age of 7 days with a percentage of 2.5% and 10% increased compressive strength values with values of 260 mpa and 253 mpa respectively. Meanwhile, the percentage of 5% and 7.5% experienced a decrease in the value of compressive strength.

In the compressive strength of 14 days old mortar, there was an optimum increase in the compressive strength value in the percentage of 2.5% coconut fiber ash with a value of 233 MPa and the lowest decrease in the percentage of 10% coconut fiber ash with a value of 213 MPa.In the compressive strength of 28 days old mortar, there was no increase in compressive strength value with the lowest compressive strength decrease value in the percentage of 10% coconut fiber ash with a value of 180 MPa.

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